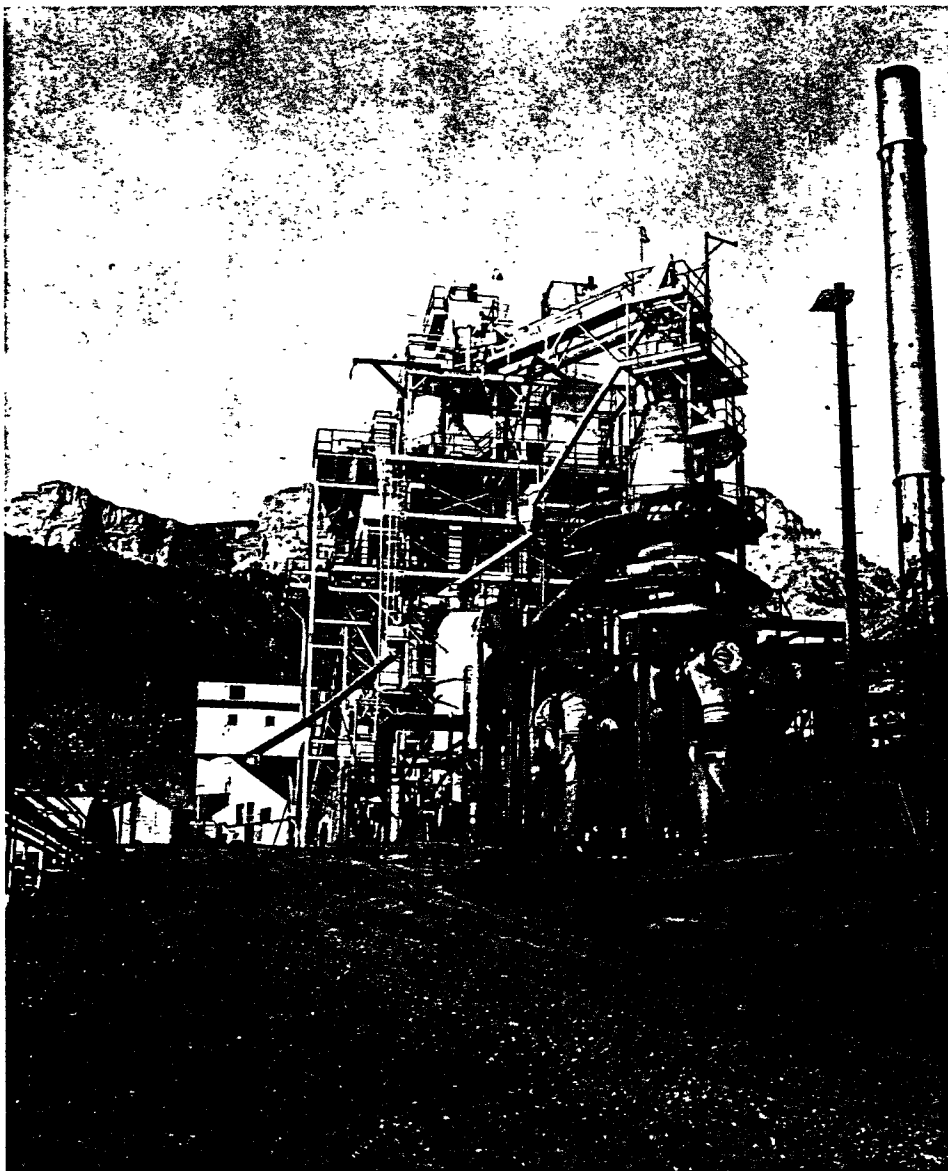


PRO/047/003

Situation Report

FILE Paraho Expands Its Technology Base



Paraho's Anvil Points oil shale facility near Rifle, CO.

Extracting oil from shale has always been—at best—an expensive, risky proposition. Even now, as oil shale gradually lumbers toward commercial production, some doubts linger about whether or not producing oil from shale will prove profitable, particularly in light of today's economics.

But at Paraho Development Corp. in Grand Junction, CO, no such uncertainties seem to exist, and managers of the small company (approximately 100 employees), bustle with enthusiasm for the oil shale industry in general and Paraho in particular. Paraho has doubled the number of employees in the past year, and if all goes as planned, could have 1,500-2,000 employees by 1986. Those plans include a proposed commercial oil shale facility, the Paraho-Ute project, 50 miles southeast of Vernal, UT, as well as continued expansion of the company's research and technology, including maintaining the facility at Anvil Points, near Rifle, CO.

Back to the Points

In fact, Paraho's history is firmly anchored to Anvil Points, where the U.S. Navy holds shale lands known as Naval Reserves One and Three. During the 1940s and 1950s, the federal government, primarily through the U.S. Bureau of Mines, conducted research on oil shale mining and processing at the site, and the knowledge gained in those years has served as a basis for much of the shale technology used today. John B. Jones, Jr., a chemical engineer, was one of the researchers who worked on the project and helped develop the Bureau of Mines retort, a vessel in which crushed shale is heated to remove the oil. When the government program was discontinued in the 1950s, Jones and Russell Cameron, who also worked on the project, formed their own engineering firm, Cameron and Jones. The company continued to research oil shale and was involved in developing the Petrosix retorting process that is now being used in Brazil. The firm of Cameron and Jones was dissolved in 1965, and Jones went on to form his own company, Development Engineering, Inc.

After he became self-employed, Jones co-invented a new retorting method that

was based on the one devised at Anvil Points in the 1950s. He considered the design simple and relatively inexpensive. Since there was no oil shale industry at that time, he decided to test the process on a commercial basis in Rapid City, SD, using the calcination of limestone. While in South Dakota, Jones met Harry Pforzheimer, Jr., who was vice president of Sohio Petroleum Co., and the two began organizing a project to test Jones' vertical retort on oil shale. The process was named Paraho, a title taken from a Portuguese word meaning "for man."

In 1971, the company's name was changed to Paraho Development Corp., and Development Engineering became a

Pooling Resources

In June 1980, Paraho entered into a contract with the U.S. Dept. of Energy (DOE) for an 18-month detail-design program of a commercial oil shale retort module. The \$9-million project consists of a mine to produce oil shale, a commercial retort to recover the shale oil and gas, as well as supporting equipment. That project is now in the final design stages.

Paraho is managing the program, and the costs are shared by DOE and 14 industry sponsors. The industry sponsors include ARCO Coal, Chevron, Conoco, Davy McKee, Husky, Mobil, Mono Power (Southern California Edison), Phillips, Placid Refining, Sohio, Sun, Texaco, Texas Eastern and The Cleveland-Cliffs Iron Co.

Sohio, Davy McKee and Cleveland-Cliffs, as well as three environmental firms, also serve as subcontractors for the project. □

Paraho subsidiary. It was 2 years later, in 1973, that Paraho moved back to Anvil Points. The government had shut down the facility after the 1940s' and 1950s' projects were completed, except to lease it occasionally to private firms during the 1960s. Now it was Paraho's turn.

Rounding up dollars

Paraho's initial oil shale work was done in conjunction with a group of 17 energy companies that sponsored the \$10 million needed for the demonstration program. The result was construction and operation of a pilot plant and a semiworks demonstration

retort. This technology was then used from 1976-1979 in a project for the Navy under a government contract, which produced 100,000 barrels of shale oil. The fuel was then commercially refined at Sohio's Toledo, OH, facility into products meeting military specifications.

With Sohio also serving as one of the sponsors of the project, Pforzheimer continued his involvement with Paraho. During the 1970s he was on loan to Paraho from Sohio and served as program director. After retiring from Sohio in 1980, he then became Paraho's chief executive officer and chairman of the board.

Pforzheimer feels plans for the company's continued expansion will become a reality. Using the knowledge gained from the company's past 10 years of research, construction on the proposed Utah site is expected to begin in the fall of 1982, with completion set for early 1986. The site will contain an oil shale mine and three modular Paraho retorts that will be phased in gradually, and which will be based on the retorting technology demonstrated at Anvil Points. It is hoped that upon completion, the Utah facility will produce more than 42,000 barrels of upgraded shale oil per day.

Those are ambitious plans for any company, but especially for one the size of Paraho, since the commercial plant will probably cost \$2 billion. "We call it creative financing," says Pforzheimer. "By using sponsors and grants, we are able to achieve much more than if we had to use our own resources." As an example, costs for developing the retort design to be used at Paraho-Ute were split by the Dept. of Energy (DOE) and a group of 14 private energy and engineering firms. In return for their support, the firms received favorable terms for licensing any of the technology developed from the project. In other words, sponsoring companies will pay less to use Paraho technology than those who did not participate in the project. Paraho also received a DOE grant for a feasibility study on the Paraho-Ute retort.

In addition to creative financing, Paraho makes the most of its resources by using subcontractors for much of the work it does. That way, even though the company itself only has 100 employees, it gets the

services of 300-400. "We can then use our staff to coordinate the subcontractors," says Pforzheimer. "By using these types of financing and contracting methods, Paraho has been able to spend \$45 million on proving its technology."

Shipping shale worldwide

Not content to stick to neighboring shale, the Paraho retort has also been used to process oil shale from Israel and Morocco, which was shipped to Anvil Points for testing. "We feel we have the basic technology for processing all different types of oil shale," says Pforzheimer. "And we expect in the future to continue adapting the retort to obtain shale oil from various types of deposits."



Harry Pforzheimer, Jr., chairman and chief executive officer of the Paraho Development Corp.

Nevertheless, the Paraho retort is constantly being refined and improved. "You can never wait for the finished product," Pforzheimer explains, "since we'll never be finished with it. There's always something we can improve."

The Paraho retort uses a gravity-feed, counter-current type of flow with gases and heat moving up and shale rock moving down the retort. The processed shale leaves the bottom of the retort in chunks. The Paraho process produces low BTU gas that can be used to generate electricity. Pforzheimer estimates that eventually, 50 megawatts of electricity could be sold to outside customers from the three-retort

facility planned for the Paraho-Ute project.

But even though Paraho officials are enthusiastic about their process, they admit it is not the only solution to processing shale oil. "When you talk about a commercial oil shale plant that produces 100,000 to 150,000 barrels a day, we'll probably be looking at a facility that uses several kinds of retorts to meet the needs of various types of oil shale," says Pforzheimer. However, because the Paraho-Ute project will be on a smaller scale—42,000 barrels of shale oil a day—it will use only Paraho retorts.

Even though plans call for the project to begin this year, there are still some permitting, planning and financing hurdles to be surmounted. Paraho officials have started obtaining the federal and state permits required before plant construction can begin, and Pforzheimer says, "We are hoping to have all the permits approved by October."

Also, a Paraho task force is currently examining the information gained from the 18-month retort-design study. Once that material is digested, a proposal will be presented to the 14 sponsors, along with suggestions on the best ways to move forward with the commercial plant.

The financing hurdle depends on the Synthetic Fuels Corp.'s approval of a loan guarantee for 75 percent of the \$2-billion project. If that is okayed, the remaining 25 percent financing would be provided by Paraho and "possibly" four-six other companies. Says Pforzheimer, "In a project this size, it would be almost impossible to have the 14 to 17 sponsors we've had on our research and design phases of the retort, because it would be difficult to get them all to agree on one thing."

Once financing is obtained and the necessary permits are approved, Paraho can begin construction on its project site just north of the White River. The company has used a variety of methods to obtain the parcel, including leasing, subleasing, options and purchase. "When you're a small company like ours, you have to figure out alternative ways to get things done," says Pforzheimer. The company hopes to acquire even more oil shale property in 1982.

Diversified research

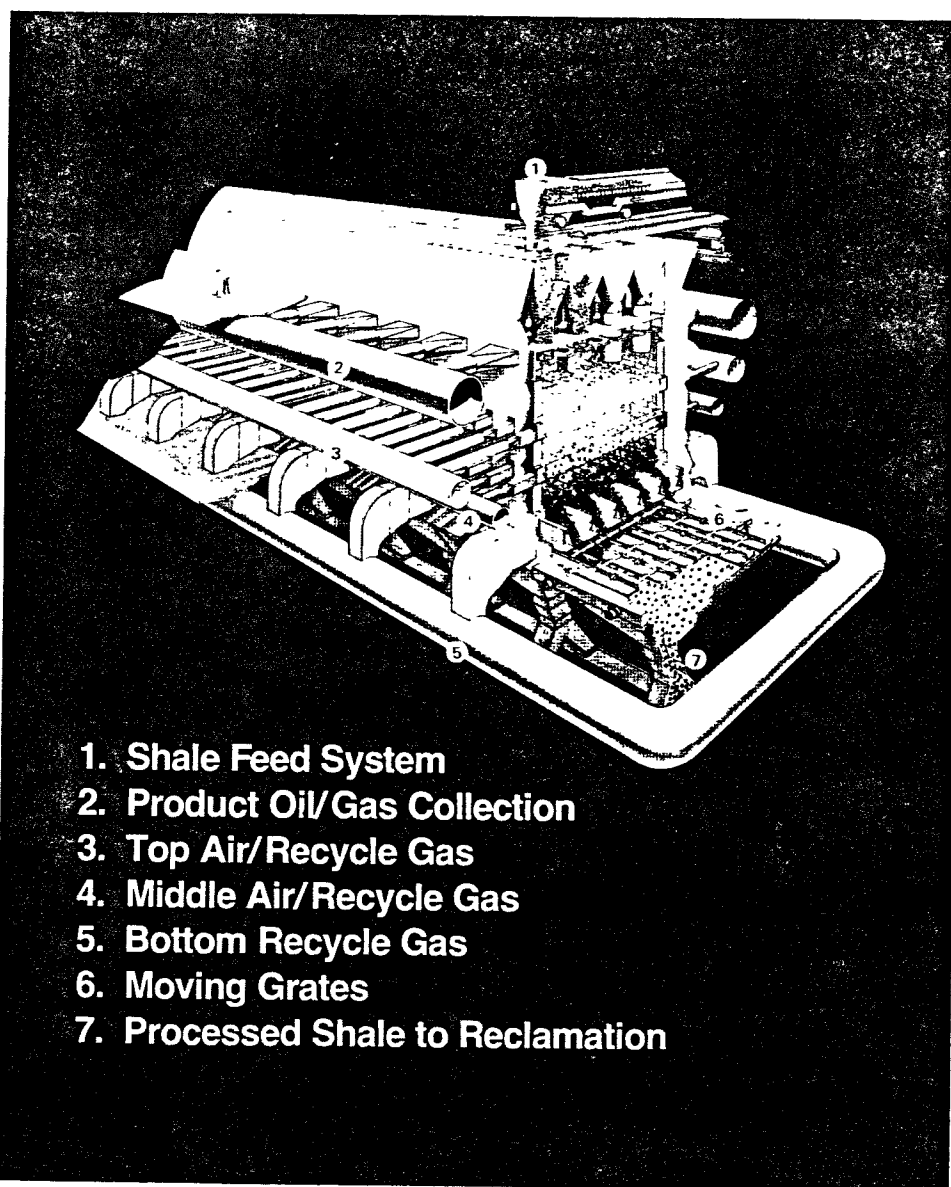
But bringing the Paraho-Ute plant on-line is not all that occupies the employees.

Other development and research projects continue to keep the firm's technology up-to-date. For example, Marathon Oil Corp. is working with Paraho to utilize the Paraho retort with process changes specified by the oil company. The major difference between the two processes, says Pforzheimer, is that while Paraho's retort uses a direct heating method, Marathon uses super-heated steam.

Another aspect of oil shale processing—methods of blasting the rock—is being investigated at Anvil Points in cooperation with Scientific Application, Inc., of Denver, CO. The two firms are

exploring the best ways to fracture oil shale for modified in-situ (underground) retorting. Paraho also offers analyzing services for various private and government operations through its laboratory and testing facilities at Anvil Points.

Because of such diverse projects and the company's move toward commercial production, Pforzheimer views Paraho's future optimistically. And, he adds, to keep up with the constantly changing oil shale industry, Paraho intends to continue searching for better ways to expand the technology base it has crafted over the years. S.L.P. □



Paraho's commercial module retort.